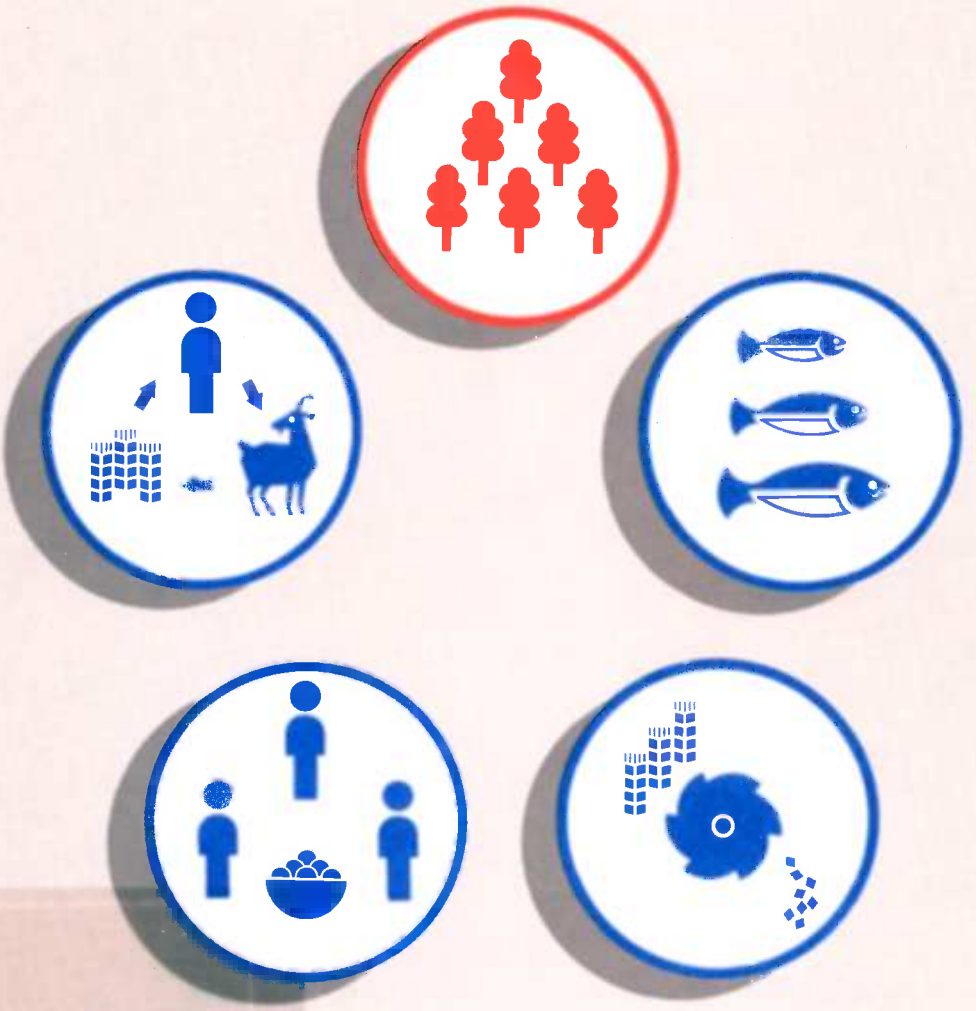
Agriculture, Food and
Nutrition Sciences

Forestry Program



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Il existe également une version française de cette publication.

La edición española de esta publicación tambien se encuentra disponible.

Forestry Program

Foreword

This booklet is intended to familiarize researchers and research-funding agencies with the scope of research supported by the Agriculture, Food and Nutrition Sciences Division of the International Development Research Centre (IDRC). It also provides information on how IDRC works with scientists in identifying research priorities and on the kind of support provided to researchers for developing and executing projects in the field of forestry research.

In recent years, agricultural research has become increasingly international in scope, often with the participation of numerous institutions from several countries, each contributing its own particular expertise. At the same time, Canadian universities and research organizations have become increasingly interested in the agricultural problems of developing countries. As a result, these Canadian groups have strengthened the scientific capabilities needed to participate in the research efforts that are critical to ensuring sustainable agriculture and an equitable distribution of its products. We hope that this booklet will help to explain IDRC's role as a research-funding agency in this increasingly interconnected agricultural research environment.

The production of this booklet was a team effort by various IDRC staff members. The assistance of two people, in particular, is gratefully acknowledged: Derek Webb, Associate Director responsible for IDRC's Forestry Program, and Liliana Wagner, Executive Scientific Assistant for the Division, who coordinated the writing of this series, which includes four other booklets.

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The International Development Research Centre

The mission of the International Development Research Centre (IDRC) is to contribute to development through research and research-supporting activities. The Centre aims to assist in promoting the indigenously determined social and economic advancement of the developing regions of the world, with particular focus on the poorest people of those regions.

Within this mission, IDRC has two principal objectives: first, to support research of direct relevance to Third World development and having direct, demonstrable links to the basic needs of the poor; and, second, to assist developing countries to build indigenous research and research-supporting capacity, mainly at the national, but also at the regional, level and mainly in terms of human resources.

IDRC aims at these objectives by focusing its activities in six main areas: agriculture, food, and nutrition sciences; communications; earth and engineering sciences; health sciences; information sciences; and social sciences. IDRC also funds training in all these areas.

The Agriculture, Food and Nutrition Sciences Division

The world food situation is generally more positive than it was a decade ago. Food production is increasing at about 2.6% per year, slightly faster than the growth of the population but still below the increase in demand for food. More importantly, however, a considerable proportion of the world's population continues to receive much less than the minimal nutritional requirements. Technological innovation in food production has largely been concentrated in East Asia. Recent efforts to duplicate this achievement in Africa have been less successful because many of the prerequisites for success are not yet present there.

The Agriculture, Food and Nutrition Sciences (AFNS) Division's mission within the Centre is to contribute to agricultural development through specific research and research-supporting activities designed to make adequate food available to the individual and to improve the production, protection, preservation, processing, distribution, marketing, and utilization of agricultual commodities of plant and animal origin from land- or water-based systems, including forests. The scope includes the transformation of these commodities and the development of related industrial technologies to generate employment and income to enable people to purchase food. It also includes improving the use of land resources and protecting natural resources for future agricultural production.

The Division gives high priority to dissemination of research results and training of research staff in developing countries. On average, 2–5% of the project funds are now allocated to publications and dissemination workshops. Most AFNS projects contain a specific training component, which averages 10% of the project budget.

The Division's strategy is to support indigenous applied research carried out in close association with rural households, which make up 70% of the people in developing countries and who are to use and benefit from the research. Because effective research requires international linkages for evaluating germ plasm, exchanging information, training, and developing technology, AFNS also supports more advanced research in international and regional research centres, as long as such work is directly relevant and complementary to specific research projects or networks with national programs. Similarly, when Canadian institutions offer relevant expertise, the Division funds cooperative projects that are undertaken jointly by Third World and Canadian scientists.

AFNS supports research projects through five programs: Agricultural Economics, Crop and Animal Production Systems,

Fisheries, Forestry, and Post-Production Systems. This booklet reviews recent activities and outlines the future directions of the Forestry Program. Brief reviews of the other four AFNS programs begin on page 23.

The Forestry Program

Introduction

During the past decade, many developing countries have increasingly recognized the importance of forests and trees in helping to raise agricultural productivity, improve rural welfare, alleviate the effects of the energy crisis, and preserve the environment. Forestry development underwent a major shift toward these areas of concern but forestry research has not yet expanded to cover these new fields of interest.

Before describing the aims and achievements of IDRC's Forestry Program, it is important to outline the worldwide context in which it operates.

More than 90% of the limited forest-research expenditures made by developing countries has been allocated to using natural forest resources, creating new industrial plantations, and studying better industrial use of the resource. By contrast, research into fuelwood, charcoal, and other wood-based energy products, which together account for almost 80% of total wood consumption in the developing world, has been minimal. Although industrial forestry research will remain important to those countries where the forest is a major resource, a fresh look at research priorities is clearly needed. Only about 40 of the more than 100 developing countries can claim to have a significant area of closed high forest. A recent survey by the Food and Agriculture Organization (FAO) of the United Nations on the availability and use of fuelwood identified about 70 countries as having insufficient wood resources.

Program Objectives

The recognition of the changing pattern of people's requirements for the wood resources in developing countries and their government's ability to respond to them defines the direction and priorities of IDRC's Forestry Program.

The objectives of the Forestry Program for the next 5 years, based on priorities established by past experience and foreseeable future needs, are sixfold:

- To concentrate on integrated, or social, forestry rather than industrial forestry development;
- To allocate resources to four major research fields: integrated forest-production systems, fuelwood and energy applications, management and regeneration of natural forests, and forest-product utilization;

- To seek solutions to existing problems, within these fields, by developing faster, low-cost, applied-research methodologies and low-input technologies;
- To strengthen national research capabilities by supporting national institutions and training local research scientists, especially in Africa;
- To encourage greater communication and collaboration between institutes and researchers through networking and sponsoring of relevant meetings and travel; and
- To further the "twinning" of Canadian and national research agencies of Third World countries through joint research activities or cooperative projects.

Background

Target Population

The rural poor is the target population for IDRC assistance. Some social research is usually required to identify the needs, constraints, and acceptance of change by this population. Socioeconomic studies also help to forecast changes and future requirements.

Many Third World governments are influenced by strong internal and external forces and must set their priorities in response to these pressures. To date, IDRC has been able to work within government priorities and to support government research institutions while, at the same time, emphasizing work that benefits mostly the rural poor.

In past years, IDRC's Forestry Program achieved considerable success in anticipating developments in forestry, in helping governments to reorient some of their priorities, and in sponsoring agencies that accurately perceive what will benefit the rural poor. Early IDRC support for research in agroforestry, woodstoves, and bamboo and rattan is a good example. Until recently, the governments of Southeast Asia emphasized the establishment of industrial pine plantations, but these generally have not been successful. Through research sponsored by IDRC, these governments have become aware of the significant economic value of native bamboo and rattan.

Forestry Research Needs and Problems

Four topics will be the major subjects of research in the forestry sector in developing countries over the next few years:

- The contribution of forestry to rural development, including the productive and protective functions of trees and forests, with

increased emphasis on research into farming systems that incorporate trees and watershed protection;

- The production and use of energy, developing ways of increasing the productivity of trees to generate the maximum biomass and energy yield per unit area in the shortest possible time, and conserving resources by more efficient use of wood, for example, through improved woodstoves;
- The conservation and management of tropical forests more effectively with special reference to their regeneration and enrichment; and
- The utilization and marketing of timber from secondary species and the utilization of woody residues.

Traditional research programs of course should continue but the emphasis of research should shift to reflect the changing needs and capabilities of the developing world. Considering the scenario in which forest research operates within the developing world, five topics generate both problems and opportunities.

First, IDRC believes that well-conceived national research will be more enduring and beneficial than imported research. The Program, therefore, gives priority to strengthening national research institutions, most of which are severely constrained by the lack of operating funds.

Second, a general shortage of trained researchers is often exacerbated by the drift of scarce staff to more financially

rewarding and comfortable posts in administration. By increased emphasis on training, IDRC works toward enlarging the pool of trained scientists to allow for this inevitable loss of researchers.

Third, lack of communication between national organizations and individual researchers is recognized as a major bottleneck. Better contact can be stimulated by an increase of project networking.

Fourth, international and bilateral research and development programs lack coordination. Closer contact with major sponsors of development programs at the design stage of their projects could ensure not only the provision of the necessary research and assure its success, but also a wider application of the research results. The basic principle that research should precede development must be emphasized and applied.

Fifth, to build-up national research organizations will take time; therefore, existing capacities must be used more effectively. At least 90 research centres are in place, 50 in the developed world and 40 in the developing world. The Forestry Program intends to take greater advantage of this situation by supporting twinning between Canadian and Third World research groups through cooperative projects.

Other Agencies in the Field

Two of the important changes that have occurred in forestry research in the developing world are the recent increase in the number of agencies that support forestry research and the establishment of a secretariat by the International Union of Forest Research Organizations (IUFRO). IUFRO is mandated to identify forest research needs in the developing world and to stimulate input by researchers from institutes in developed countries.

Of the 2500 million CAD provided by sponsoring agencies for forestry development during the past decade, only 200 million CAD (8%) has been spent on research: the largest single sponsor, the World Bank, allocated only 3% of its investment to research. Even this low value gives an inflated picture, because pilot projects are frequently described as research. Nevertheless, there is a notable trend for more agencies to spend more of their funds on research, in many cases because of the costly failures of technically unsound development projects in the past.

Based on reported statistics, IDRC is currently the seventh largest sponsor of forestry research projects. In the past decade, IDRC made grants of 8.2 million CAD, which represents about 4% of the total 200 million CAD spent on research. Because the total of these grants was applied directly to forest research, their impact may have been greater than the figures indicate.

Within this international framework, IDRC's Forestry Program defines its most useful role keeping in mind the target beneficiary

and the resulting socioeconomic implications. Priorities are established taking care not to compete with or duplicate the efforts of other organizations. At the same time, the priorities retain sufficient flexibility to allow a shift in direction should other agencies move into the same field later.

Institutional Aspects

Most projects supported by the Forestry Program have been funded through state research institutes or forest services. With some notable exceptions, university research departments in forestry tend to concentrate more on basic rather than applied research.

For forest research projects, national forestry institutions offer both strengths and weaknesses. Among their strengths are the ability to relate research to development needs and the close involvement of local staff in planning and implementing research. Their weaknesses include lack of trained personnel, shortage of funds and facilities, vulnerability to change, and a tendency to duplicate research completed or in progress elsewhere. The upgrading of national research capabilities demands the training of staff to the appropriate level for research, provision of adequate operational funds, and supply of equipment. It is common, especially in Africa, to find that the budgets of national institutes cover only the salaries of staff, leaving no funds for work or travel in the field. Encouragement and moral support from Program staff and

consultants can mean much to the isolated scientist working in an environment that is not oriented to research.

The levels of institutional capacity and infrastructure in place show clear regional patterns, with Africa generally lowest, Latin America at an intermediate level, and Asia at the top. This pattern is repeated in the availability and quality of local training bases. IDRC's support recognizes such regional differences in its evaluation of the research needs and the level of capability in place in any specific area or country.

In forestry, with the exception of the International Council for Research in Agroforestry (ICRAF), which does not undertake hands-on research, there are no international centres comparable with those of the Consultative Group for International Agricultural Research (CGIAR) system. The option of working through international centres does not exist in forestry at present.

Review of Activities

In the early 1980s, the Program followed its original plan with two notable exceptions. In response to the rapid development of many projects in the field of rattan and bamboo, more emphasis was placed on tree improvement with a consequent reduction of activities in forest-product utilization. Fund allocations and projects in different regions and subprograms are summarized in Table 1.

Emphasis also shifted substantially to Latin America because recruitment of program staff in that region provided a better appreciation of the needs and potential there. Staff within the pro-

Table 1. Actual allocations (000 CAD) to IDRC-supported projects[a] by regional office, 1980–1984.

	Regional office						Totals	
Subprogram	Nairobi	Dakar	Cairo	Bogotá	New Delhi	Singapore	Amount (CAD)	%
Afforestation	1032 (4)	577 (4)	0 —	2139 (7)	0 —	0 —	3748 (15)	29.4
Tree improvement	341 (1)	193 (2)	229 (1)	565 (2)	229 (2)	1718 (9)	3275 (17)	25.7
Integrated production systems	1199 (3)	503 (4)	0 —	659 (2)	612 (2)	0 —	2973 (11)	23.3
Product utilization	318 (3)	0 —	0 —	810[b] (6)	79 (1)	234 (3)	1441 (13)	11.3
Environmental forestry	0 —	232 (1)	728 (3)	0 —	0 —	0 —	960 (4)	7.5
Other	0 —	0 —	0 —	0 —	0 —	340 (1)	340 (1)	2.7
Totals								
Amount (CAD)	2890	1505	957	4173	920	2292	12737	
%	22.7 (11)	11.8 (11)	7.5 (4)	32.8 (17)	7.2 (5)	18.0 (13)	(61)	100.0

[a] Values in parentheses are numbers of projects.
[b] Includes supplement on earlier project.

gram increased from one person in 1980 to five in 1984 and officers are now located in five of the six IDRC regions.

The stated goal of the Forestry Program, to concentrate on integrated rather than industrial forestry, has been attained. Minor components of a few projects can be applied to industrial plantations (tree-seed improvement research, for example), but all projects address, at least in part, integrated forestry.

The Program achieved some success in recognizing early the research needs in such fields as agroforestry, bamboo and rattan, *Paulownia*, and woodstoves. In certain areas, however, the accurate identification and development of research projects have not produced the expected results. This is especially the case in the Afforestation and Integrated Production Systems subprograms in West Africa, where both the research capability and infrastructure are weak and the difficulties of carrying out research in the region were underestimated.

Subprograms of the Forestry Program

The Forestry Program is divided into five subprograms: Afforestation, Integrated Production Systems, Forest Product Utilization, Tree Improvement, and Environmental Forestry.

Afforestation

The establishment of forest plantations is a top priority in the dry zones of Africa and South America where expanding populations have been rapidly destroying the natural forests in their need for fuelwood. Many countries that once enjoyed an abundance of trees can no longer provide their local population with the minimum requirements for fuel and building materials. The existing, depleted, natural forests have survived fire, browsing, and other hazards only by developing a hardiness that extracts its cost in lower productivity. The surviving tree stands and species are very slow growing. The depleted forest resources must now be augmented by plantations and woodlots. Fast-growing exotic species require careful cultivation but can increase wood production 50-fold. This production advantage is partially offset by the increased risk of potential losses as a result of pests and diseases to which the indigenous species are resistant.

In the dry zones of Africa and the upland zones of South America, the Afforestation subprogram, to date, has concentrated on research into the selection of fast-growing exotic and native species, and their establishment and management. The emphasis in all projects is on developing simple techniques that can be used by villagers in small-scale plantation programs.

In eastern and southern Africa, four projects concentrate on the establishment of woodlots in dry marginal lands in an effort to lessen the critical fuel shortage. Some success has already been achieved. In West Africa, four similar projects in Burkina Faso,

Mali, Niger, and Senegal are focusing not only on fuelwood production but also on the effectiveness of foliage and fruit of various trees as sources of animal fodder, a particularly important use of trees in this zone.

In Latin America, two sets of problems for tree growth are under study. In the high-altitude areas of the Andes in Bolivia, Colombia, and Peru, drought, low temperatures, and high light intensities present special difficulties. The Peruvian project has now largely solved these problems and is proceeding with pilot demonstration woodlots. The second topic of research, similar to the one in Africa, is concerned with establishing plantations in arid zones. Projects have been started recently in Brazil, Chile, Peru, and Haiti.

Support for afforestation research in general has been rewarding. It does not require high technical inputs or research capacity and is well within the reach of national researchers in Africa and Latin America, the two continents where the need is greatest. The subprogram will continue to give priority support in these regions.

Integrated Production Systems

Shifting cultivation, or slash-and-burn agriculture, is still the predominant form of land use throughout the tropics. The system works well when periods of bush fallow are long enough to allow the replenishment of soil nutrients. The pressure of increased population, however, has reduced the periods of fallow and caused a progressive depletion of the soil. The agroforestry system — growing trees or shrubs on the same land as agricultural crops or grazing animals — offers a more efficient use of the land. Trees or shrubs help to maintain soil fertility by fixing nitrogen and returning nutrients to the soil in the form of organic matter. The woody plants also provide firewood, building materials, shade, forage for animals, and sometimes edible fruit. Farmers receive an additional small income from the nonagricultural crop to relieve some pressure on the land.

In the late 1970s, the Forestry Program built a network of agroforestry projects in West Africa that have all been ended. Their results proved disappointing largely because the project leaders failed to use an interdisciplinary approach. A second regional network that stresses the importance of inputs from agronomists, foresters, and other disciplines, is now in place. Projects supported in Nigeria, Sierra Leone, and Zaire are working on incorporating nitrogen-fixing trees into agroforestry systems in the humid tropics. In South Asia, projects in India and Nepal focus on developing pastoral forestry systems in semi-arid conditions.

The Forestry Program has maintained its support of ICRAF, which offers guidance to the national research institutes throughout the world. With ICRAF's assistance in design and methodology, two projects in the semi-arid zone of Kenya and in

the Peruvian Amazon have recently received IDRC funding. They and future projects will be developed and monitored in collaboration with the Crop and Animal Production Systems and Agricultural Economics programs.

Agroforestry demands a high research capability and considerable technical assistance and moral support are clearly required, especially in Africa, to produce the desired results.

Forest Products Utilization

In the humid tropics, loggers over centuries have damaged or destroyed the hardwood forests in their search for a few marketable species. Most other species that are potentially valuable were discarded or burned in the subsequent clearing for colonization. This waste was caused by insufficient knowledge of the properties and uses of noncommercial timber.

IDRC has supported several projects in South America to evaluate noncommercial species. The largest of these involved the five countries of the Andean Pact (Bolivia, Colombia, Ecuador, Peru, and Venezuela). The objective has been to investigate the properties of lesser-known hardwoods and to promote their use by publishing design manuals for the construction industry. Similar research is now being supported through projects with national timber laboratories in Bolivia and Paraguay.

The lack of grading systems in many developing countries leads to the inefficient and sometimes dangerous use of timber in construction. Projects underway in Mexico and Zimbabwe are researching this topic with the intention of publishing grading standards and design-stress values. Wood-energy utilization is another area that has received support. A project in the Philippines is developing a small-scale energy system based on wood gasification designed for rural communities. Small projects in Tanzania are studying new methods of charcoal production and designs for charcoal-burning stoves. Other IDRC-supported projects are researching the production of wood adhesive and of raw materials for tanning.

With the notable exception of Zimbabwe, the research capacity of African countries is very weak in forest-product utilization. Without high inputs in training and facilities, it will be difficult to support research on forest-products utilization in Africa in the next few years. Results from current projects in Latin America and the available capacity for research in this field in Asia justify concentration on these regions.

Tree Improvement

Research into tree improvement and breeding is relatively new compared with the studies carried out over many decades on agricultural and horticultural crops. Enormous strides have been made in the past 30 years, but much work remains to be done at all levels — from improved methods of seed collection, storage, and

treatment through the testing and choice of suitable species to the genetic selection of improvements of individual strains to meet particular site requirements.

The principal and highly successful activity in this subprogram has been the establishment of a strong network of 10 Asian projects working on selecting and improving bamboo and rattan. In projects in Bangladesh, China, Indonesia, the Philippines, Sri Lanka, and Thailand, living collections of local species have been established for evaluation. Propagation methods, cultural techniques, and the properties of species that are now unused are also under study. Similar projects studying various species are being supported in China (*Paulownia*), Costa Rica (*Erythrina*), the Philippines (*Leucaena*), and Sudan (*Prosopis*).

Tissue-culture techniques, which can accelerate tree-improvement studies, are receiving support in projects in Colombia, Malaysia, and Senegal. Tree improvement, particularly using these techniques, is a sophisticated field of research that demands both a high level of skill and of infrastructure. These, generally, are more readily available in Asia where the efficient operation of the Program is expected to continue. At a lower level of scientific refinement, research into seed collection and storage can, potentially, be carried out successfully in Africa and Latin America.

Environmental Forestry

Years of research in the temperate zones, including the Mediterranean region, have led to an understanding of the design and aerodynamics of shelterbelts in these areas. Although some countries, notably Nigeria, have large-scale programs for establishing shelterbelts, the concepts and designs derived from temperate zone research are not necessarily suited to African countries. Little or no research on this topic has been carried out in Africa south of the Sahara.

IDRC has supported a network of four shelterbelt projects in Africa, each with a different research emphasis.

- In Nigeria, the project addresses the influence of shelterbelts on rain-fed agricultural crops;
- In Sudan, the problem is the control of desert encroachment on irrigated agricultural land;
- In Egypt, the objective is to identify the most suitable species and varieties of *Casuarina* for use in shelterbelts; and
- In Tunisia, the project is studying the effects of shelterbelts on horticultural and fruit crops.

The Egyptian *Casuarina* project gave excellent results. The other three projects have been slow in producing results because of a combination of factors: the length of time required to build shelterbelts of sufficient size to permit subsequent crop research; the inadequate scientific capability of local researchers, which

demanded considerable technical input from outside experts; and the inaccessible location of trials, which were picked on the basis that they were representative of different site conditions but proved difficult to monitor.

Support Activities within the Forestry Program

Several additional activities, designed to assist national institutions and researchers, have been carried out under the Program.

Training

The Forestry Program organized and sponsored regional courses on forest research methods and design at the universities of Los Baños (Philippines) and Morogoro (Tanzania). In cooperation with the Graduate School of Management at the National University of Singapore, the Program presented a course designed to train senior scientists in managing research and development and applying technology in forestry. The courses were successful and more are planned.

Workshops

IDRC sponsors workshops based on regional project networks. They are designed to promote contacts and the exchange of information among researchers working in similar fields. They highlight research needs and priorities and often lead to the identification of

new projects. Recent workshops have been held on the subject of *Leucaena* research in Singapore, on high-altitude afforestation in Bogotá, and on shelterbelts for Africa in Tunis.

The Forestry Program also supported initiatives of IUFRO to specially promote research in least-developed countries (LDCs). Until 1983, IUFRO largely confined its activities to interchanges between forest researchers in developed countries. Over the last 4 years, in line with its wide mandate, IUFRO organized a series of regional workshops to identify needs and to channel support for forest research in the Third World. The Program provided the financing for preliminary fact-finding studies and sponsored many of the participants from developing countries at the four workshops held in Manaus (Brazil), Nairobi (Kenya), Huarey (Peru), and Kandy (Sri Lanka). IDRC will continue to support similar workshops in the future.

Publications

During the past 5 years, the Forestry Program together with IDRC's Communications Division produced several publications. They presented technical syntheses as well as the proceedings from Program-sponsored workshops.

The Program also collaborated with the Communications Division in the production of films on the African fuelwood problem, multiple-purpose trees, bamboo, and rattan.

Evaluation

Over the past 5 years, the Program has achieved important successes. The experience gained in supporting forestry research in different continents and in environments ranging from desert-like to tropical rain conditions has identified critical factors in the design and development of a project that may lead to subsequent problems. These include

- Overoptimistic assessment of local research and institutional capabilities;
- Choice of research sites that are too remote or difficult to access and, therefore, hard to control;
- Complicated organizational structure and the division of administrative and operational responsibilities; and
- Insufficient monitoring.

Research Needs and Future Directions

The forestry staff of IDRC has carefully evaluated the options meriting support. Their assessment has been based on the following factors: national program priorities; other possible supporting agencies in the field; response time; point of intervention in

terms of the beneficiaries; "leverage" on the system; level of national capacity present and required; ratio of needed research inputs to expected benefits; and regional impact.

As a result, priority for IDRC support will be directed to four major areas:

- Integrated production systems and fuelwood–energy production sectors — these are the problem areas that should receive more resources than other sectors;
- Fuelwood yield and marketing, village technology, and natural forest improvement and regeneration — support to these enterprises is of the highest priority;
- Sociological aspects of integrated production systems, farming systems, silviculture, wood derivatives, secondary species, and minor forest products — these six enterprises warrant substantial support only in specific regions, where appropriate intervention can show valuable results; and
- Watershed–range management and natural forest conservation — these merit only limited support.

On a geographic basis, the emphasis lies on building up the Forestry Program in South Asia. After their rapid growth over the last few years, the Latin American and Southeast Asian programs will be consolidated. The Middle East and North Africa regions will remain of lowest regional priority, at least until improvements in project efficiency and delivery can be demonstrated. The proportion of allocations to Africa will probably not increase, because the ability of most African institutes to absorb additional research funding is limited by their small staff and low level of infrastructure.

The strategies to be applied within this framework of priorities will emphasize:

- Project networking within the priority enterprise;
- Development of lead projects in new priority fields or regions, or both, in which past experience has been poor;
- Inclusion of nongovernmental organizations (NGOs) to improve the dissemination of results;
- Encouragement of twinning with Canadian centres through cooperative projects in certain research fields; and
- Support of regional training centres in Africa.

Although the Program maintains its past policy of emphasizing integrated rather than industrial forestry, a major restructuring of subprograms and their priorities is taking place. The variation in levels of research capacity in different regions, and in some cases countries, will be more clearly recognized in selecting appropriate enterprises and levels of intervention for support. The aim will be to achieve a "mixed basket" of projects but with emphasis on

recipients who can be relied on to deliver and disseminate their research results. In areas of higher risk, effort will be made initially to support weaker recipients in fields demanding a low level of research capacity.

Other Programs of AFNS

Agricultural Economics

The Agricultural Economics Program was created in 1984. It is concerned with the production, distribution, and consumption systems in which rural households function. The three research areas identified for support are

- Natural resource production and utilization systems;
- Technology introduction to increase the efficiency of the practices used to introduce technology; and
- Resource allocation in agricultural research, which concentrates on improving research management and organization.

The emphasis is on projects that are an integral part of the research program of an institute that will become directly involved in the generation and dissemination of technology. Many of these projects complement, or are joint activities with, other programs of IDRC.

Crop and Animal Production Systems

The overall objective of the Crop and Animal Production Systems (CAPS) Program is to support research on crop and livestock production with priority to research that will benefit small-scale farming families. Increased access by the poor to food and other basic necessities is given priority over research aimed at increasing agricultural productivity per se. Although there is a strong research bias toward increasing smallholder food production, other commodities are not neglected when they can make an important contribution to alleviating rural poverty.

CAPS gives special attention to semi-arid tropical regions, which are home to many of the world's poorest people. These areas have also benefited the least from past achievements of agricultural research.

Projects supported by CAPS are often linked in networks in which the various participants are encouraged to interact to their mutual advantage. Scientists working on common problems meet regularly to exchange information and ideas.

CAPS attaches special importance to applied research that is likely to have a rapid effect at the farm level. More basic or strategic research is also needed, however, and many of the biological advances of recent years have much to offer the developing world. In such cases, scientists in developing countries may be linked, with advantage, to their counterparts in Canada to make use of the

special expertise in Canadian institutions. Such cooperative projects account for about 20% of CAPS' current budget.

CAPS encourages a systems approach to research. In this approach, multidisciplinary teams of scientists work closely with the farming communities to help identify their actual problems and needs and to ensure that interventions designed to solve them are appropriate to the specific circumstances. Special attention is paid to the needs of disadvantaged groups such as the rural landless and women.

Research on cropping systems has been particularly successful in Asia where the increasing use of short-duration rice cultivars has opened a range of possibilities for increasing smallholder productivity. Similar research on cropping systems in Africa and Latin America is also starting to be effective.

Research on livestock emphasizes management, especially feeding systems, rather than animal breeding or diseases. Research on animal-production systems has been supported for several years in Latin America and is the focus of a regional network. Ruminants are given priority over nonruminants because they are better able to utilize poor quality feed. Systems involving cattle, and to a smaller extent buffalo and camelids, are given highest priority. However, research on sheep and goat production is expanding in recognition of their value to the poorer livestock producers. Among the nonruminants, small species such as rabbits, guinea pigs, ducks, poultry, and bees offer promising research opportunities that could benefit some of the world's poorest people and the landless.

Most small farms in developing countries are mixed; therefore, the interactions between crops and livestock must be understood in designing appropriate improvements. CAPS attaches special importance to research on such farming systems.

Crops provide about 80% of the total value of agricultural production. CAPS support of crops research focuses on a limited range of crops: in general, those that are not commonly studied but are important in the diets of and as source of income for the rural poor. In cereal research, CAPS has given a lower priority to the major cereals — wheat, maize, and rice — because of the major support from other donors and national governments and has concentrated on such species as sorghum and millet, which are staple crops for large numbers of people in semi-arid regions. In grain legumes, support has concentrated on cowpeas, groundnuts, and other tropical species in Africa and Asia, and on temperate pulses such as chick-peas, lentils, and faba beans in the Middle East and West Asia. Future funding will be increasingly allocated to such species as lathyrus and peas that do not have support from any international agricultural research centre.

Annual oilseed crops such as sesame, safflower, sunflower, rapeseed, mustard, linseed, and niger have also been neglected in the past, although vegetable oil is in short supply in many

developing countries. CAPS focuses its support for research on these crops through a network of projects in eastern Africa and South Asia.

Support for root-crops research, especially cassava, has shifted away from Latin America and is now concentrated mainly in East and West Africa and Asia. Special attention is also given to the biological control of pests of cassava.

Perennial crops are important in many smallholder systems in the tropics and subtropics. CAPS support has gone mainly to banana and plantain, including funding to establish the International Network for the Improvement of Banana and Plantain. Coffee research is also of interest and other perennial crops for smallholders are expected to be supported in the future.

A small informal research network has been established with CAPS support for Andean crops such as quinoa, *kaniwa,* oca, and ullucu. Vegetables are gaining in importance because of their nutritional value and as source of income for smallholders with access to markets.

Research on increasing supplies of animal feed focuses on the improvement of forage and pasture production, and the utilization of agricultural by-products. Pasture research is of particular importance in Latin America where CAPS supports a network of projects linked to the Centro Internacional de Agricultura Tropical (CIAT), and in Africa where another network, the Pasture Network for Eastern and Southern Africa, is coordinated by the International Livestock Centre for Africa (ILCA). By-product research is concentrated mainly in Africa and the Middle East. CAPS supports several national programs and the ILCA-coordinated African Research Network for Agricultural By-products, in these regions.

Rapidly expanding populations are increasing pressure on land and water resources in many parts of the world. In recognition of this, CAPS is giving greater attention to research on such important topics as fertilizers, soil erosion, tillage, soil-moisture conservation, and small-scale supplementary irrigation.

Fisheries

The primary objective of the Fisheries Program of AFNS is to support research on fish production that will benefit the poor. In the 1970s, it became apparent that most resources of wild fish were already exploited at near-maximum sustainable level. This situation has led the Fisheries Program to give priority to artisanal fisheries and aquaculture.

Artisanal fisheries employ some 20 million people worldwide and provide an important part of the total animal-protein supply in large areas of the developing world. Research problems include assessment of potential yields of natural stocks, efficient manage-

ment systems to ensure that sustainable yields are not exceeded, and improved post-harvest techniques to bring maximum benefits from available resources to consumers.

Because artisanal fisheries vary in nature and importance from one region to another, research support is regionally flexible. Marine artisanal fisheries are emphasized in Latin America and the Caribbean whereas inland fisheries are a higher priority in Africa and the Middle East.

Aquaculture is a major area of support in Asia and requests for funding of artisanal fisheries research are limited. Research on reservoir fisheries can be supported in all regions because of its potential for increasing net fish production.

In Asia, the Fisheries Program gives high priority to improving existing aquaculture systems. In Africa and Latin America, where aquaculture is not a traditional practice, research to develop or adapt aquaculture systems for local conditions is a high priority. The Program seeks to promote the transfer of appropriate Asian aquaculture technologies by training African and Latin American students in Asia, encouraging exchange visits by Asian staff, and by joint research on-site wherever possible. Although the emphasis is on producing food for poor populations, research into higher valued species and more intensive production methods may be justified when poor producers benefit.

Social and economic factors often hinder the spread of technically promising systems and the Fisheries Program supports research to overcome such constraints.

Post-Production Systems

The Post-Production Systems Program deals with the technology, appropriateness, efficiency, and nutritional implications of post-harvest activities for the benefit of low-income people. It covers a wide range of disciplines including engineering, biochemistry, entomology, nutrition, food science and technology, and economics and marketing.

The broad objectives of the Program are to make more and better food available to poor rural and urban consumers at the same time as augmenting employment and income. Food systems are the focus of the Program rather than specific commodities, technologies, or processes. Main activities are food processing and utilization; nutrition; food handling, drying, and storage; and equipment design, adaptation, and testing.

The Program also aims to strengthen village enterprises in the food and agricultural sectors. High priority is given to promoting and disseminating dehullers in rural milling systems, drying of staple foods and preserving perishable foods such as fish, fruits, roots, and vegetables. In all these sectors, training and institutional development are of considerable importance.

Of special concern to the Program is improving nutrition for low-income consumers, especially for such vulnerable groups as young children and pregnant and lactating women. Emphasis will continue to be on access to and supply of appropriate and acceptable foods for these groups. Close collaboration with the Health Sciences and Social Sciences divisions of IDRC on related activities is encouraged.

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